

THE THEORY OF MACHINE GUN FIRE





INTRODUCTION

“IF ANY SINGLE EVENT CAN BE SAID TO HAVE TRANSFORMED THE HISTORY OF WARFARE, IT WAS THE PERFECTION OF THE TRUE AUTOMATIC MACHINE-GUN BY HIRAM MAXIM IN 1885. ITS EFFECT WAS FAR GREATER THAN THE INTRODUCTION OF AIRCRAFT OR EVEN NUCLEAR WEAPONS TO THE BATTLEFIELD”.

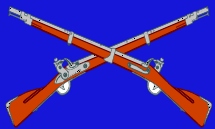
“OF ALL THE HIDEOUS WEAPONS OF WAR PRODUCED IN THE TWENTIETH CENTURY, NONE HAS EXTRACTED A MORE DREADFUL TOLL OF HUMAN LIFE THAN THE MACHINE GUN”.

FALLACY



**“THE MACHINE GUN WILL NEVER
REPLACE THE HORSE AS AN
INSTRUMENT OF WAR”.**

**SIR DOUGLAS HAIG,
COMMANDER-IN-CHIEF
BRITISH EXPEDITIONARY FORCES
DECEMBER, 1915.**



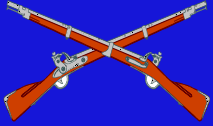
FACT:

WORLD WAR 1

1 JULY, 1916,

THE SOMME:

**ON THE FIRST DAY OF THE ALLIED
SOMME OFFENSIVE 19,000
BRITISH AND COMMONWEALTH
SOLDIERS WERE KILLED, AND A
FURTHER 38,000 WOUNDED BY
GERMAN MACHINE GUN FIRE
ALONE.**



FACT:

THE SOMME

**A SINGLE, WELL-SITED GERMAN
MACHINE-GUN WIPE OUT TWO
BRITISH INFANTRY BATTALIONS
TASKED WITH ASSAULTING THE
FORTIFIED VILLAGE OF
FRICOURT.**

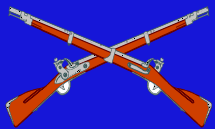


FACT:



THE SOMME

**THE BRITISH III CORPS LOST 80%
OF ITS EFFECTIVE STRENGTH AS
IT ADVANCED ABREAST OF THE
BAPAUME ROAD, BETWEEN THE
TWIN VILLAGES OF LA BOISELLE
AND OVILLERS, VIRTUALLY ALL
OF THEM CUT DOWN BY
SUSTAINED MACHINE-GUN FIRE.**

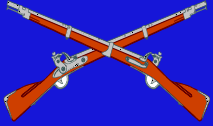


WORLD WAR 1



THE 1914-1918 WAR KILLED AT THE VERY LEAST 9 MILLION PEOPLE, THE VAST MAJORITY OF THEM ON THE BATTLEFIELD ITSELF, AND WOUNDED A FURTHER 12.5 MILLION: A TOTAL OF 22 MILLION CASUALTIES.

EVEN AT A CONSERVATIVE ESTIMATE, 25% OF THESE CASUALTIES WERE DUE TO MACHINE-GUN FIRE, GIVING A TOTAL OF 5.5 MILLION.



GENERAL DATA: M60



GENERAL DATA - M60



- **CALIBER:** 7.62mm X 51
- **WEAPON LENGTH:** 43.5in
- **GUN WEIGHT:** 23lb
- **MAXIMUM RANGE:** 3725 meters
- **MAXIMUM EFFECTIVE RANGE:** 1100 meters
- **MAXIMUM GRAZING FIRE:** 600 meters
- **MAXIMUM TRACER BURNOUT:** 900 meters +
- **RATES OF FIRE:**
 - SUSTAINED:** 100 rnds/min
 - RAPID:** 200 rnds/min
 - CYCLIC:** 600-900 rnds/min



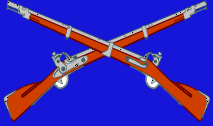
GENERAL DATA: M240B



GENERAL DATA - M240B



- **CALIBER:** 7.62mm X 51
- **WEAPON LENGTH:** 49.3 in
- **GUN WEIGHT:** 27.3 lb
- **MAXIMUM RANGE:** 3725 meters
- **MAXIMUM EFFECTIVE RANGE:** 1100 meters
- **MAXIMUM GRAZING FIRE:** 600 meters
- **MAXIMUM TRACER BURNOUT:** 900 meters
- **RATES OF FIRE:** SUSTAINED: 100 rnds/min
RAPID: 200 rnds/min
CYCLIC: 750-950 rnds/min



TERMINOLOGY



THEORY OF MG FIRE: -TERMINOLOGY-



- **LINE OF SIGHT**
- **BURST OF FIRE**
- **TRAJECTORY**
- **MAXIMUM ORDINATE**
- **CONE OF FIRE**
- **BEATEN ZONE**
- **DANGEROUS SPACE**
- **DANGEROUS ZONE**
- **DEAD SPACE**



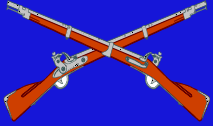
LINE OF SIGHT



LINE OF SIGHT



**AN IMAGINARY LINE, FROM THE FIRERS EYE,
THROUGH THE SIGHTS, TO THE POINT OF
AIM ON THE TARGET.**



BURST OF FIRE



BURST OF FIRE

- **A BURST OF FIRE IS A NUMBER OF SUCCESSIVE ROUNDS FIRED WITH THE SAME ELEVATION AND POINT OF AIM WHEN THE TRIGGER IS HELD TO THE REAR.**
- **THE NUMBER OF ROUNDS IN A BURST CAN VARY, DEPENDING ON THE TYPE OF FIRE EMPLOYED.**



TRAJECTORY



TRAJECTORY

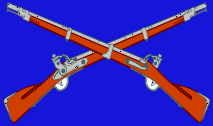
**TRAJECTORY IS THE CURVED PATH A
ROUND TAKES DURING ITS
FLIGHT.**

**THE TRAJECTORY OF A ROUND IS
AFFECTED BY AIR RESISTANCE AND
GRAVITY.**





MAXIMUM ORDINATE



MAXIMUM ORDINATE

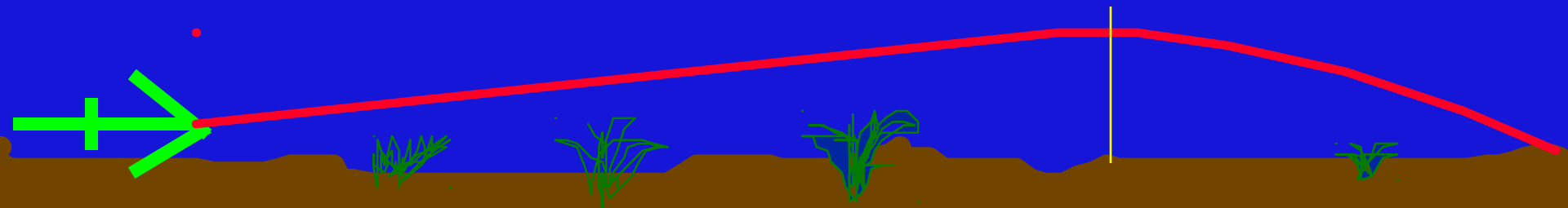


MAXIMUM ORDINATE IS THE HIGHEST POINT ABOVE THE LINE OF SIGHT TO WHICH A PROJECTILE RISES DURING ITS FLIGHT.

THE MAXIMUM ORDINATE OCCURS APPROXIMATELY $\frac{2}{3}$ OF THE WAY ALONG THE TRAJECTORY OF THE PROJECTILE.

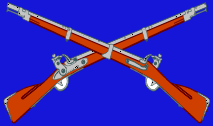
AS THE RANGE INCREASES, SO DOES THE HEIGHT OF THE MAXIMUM ORDINATE.

MAXIMUM ORDINATE





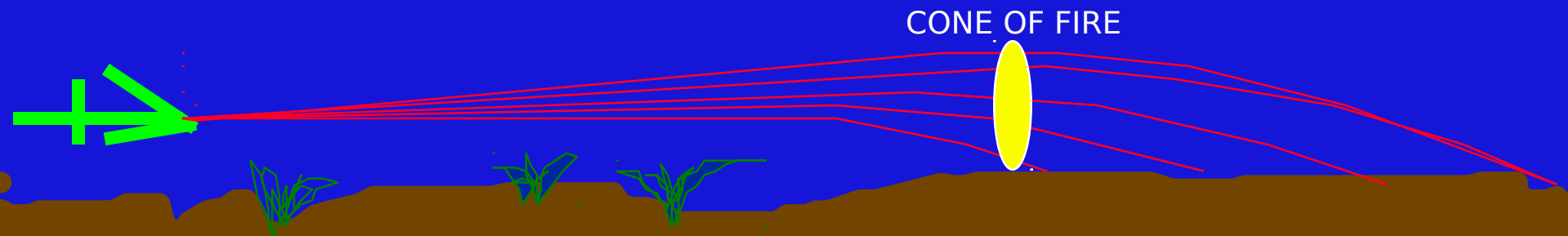
CONE OF FIRE

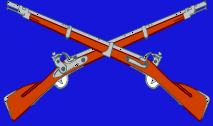


CONE OF FIRE

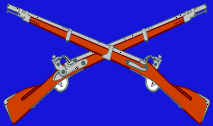
THE GROUP OF TRAJECTORIES RESULTING FROM A BURST OF FIRE IS TERMED THE CONE OF FIRE.

WHEN A BURST OF FIRE STRIKES A VERTICAL TARGET, THE ROUNDS WILL FORM A PATTERN, OVAL IN SHAPE, WITH THE DENSITY OF SHOTS DECREASING TOWARDS THE EDGES.



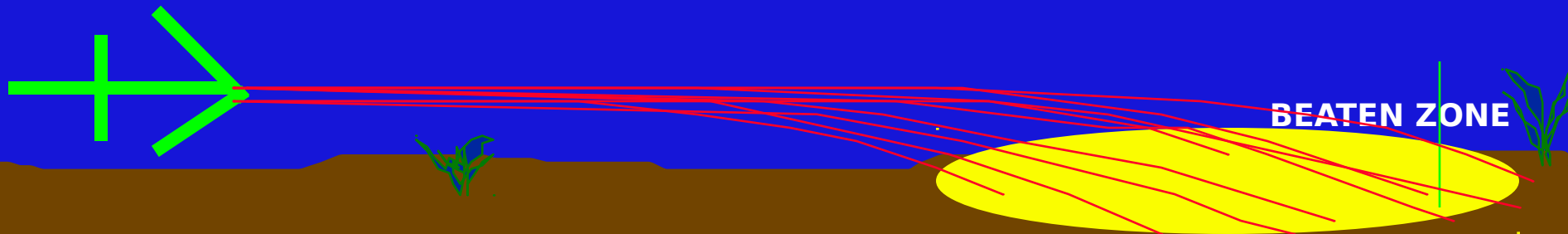


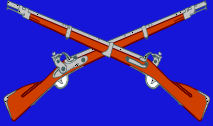
BEATEN ZONE



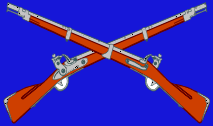
BEATEN ZONE

THE PATTERN FORMED WHEN THE CONE OF FIRE STRIKES THE GROUND IS TERMED THE BEATEN ZONE. IT IS OVAL OR CIGAR SHAPED AND THE DENSITY OF ROUNDS DECREASES TOWARDS THE EDGES. BECAUSE OF DISPERSION ONLY THAT PART OF THE BEATEN ZONE IN WHICH 85% OF THE ROUNDS FALL IS CONSIDERED THE EFFECTIVE BEATEN ZONE.





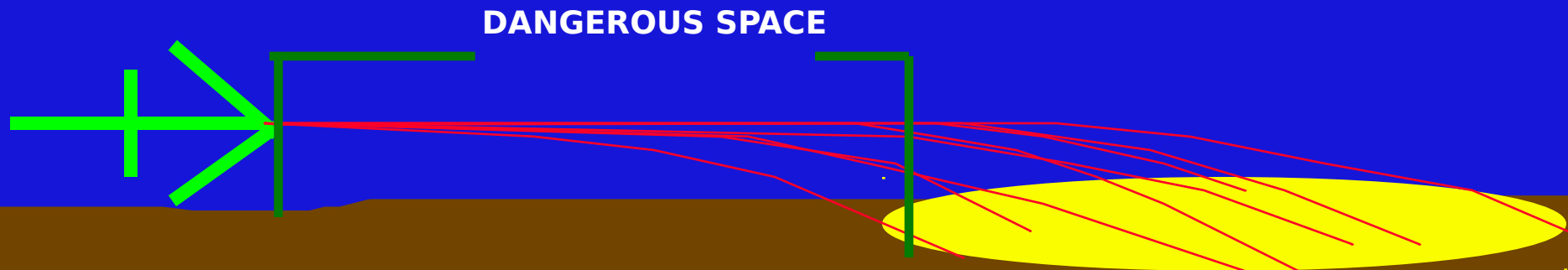
DANGEROUS SPACE

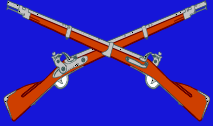


DANGEROUS SPACE

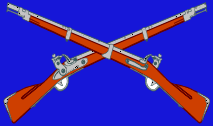


DANGEROUS SPACE OCCURS BETWEEN THE MUZZLE OF THE MACHINE GUN AND THE POINT WHERE THE LOWEST ROUND IN THE BEATEN ZONE STRIKES THE GROUND.





**DANGEROUS
ZONE**

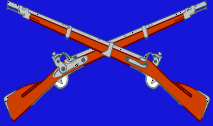


DANGEROUS ZONE

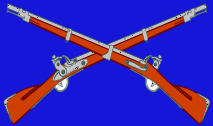


THE DANGEROUS ZONE IS THAT AREA COVERED BY THE DANGEROUS SPACE AND THE BEATEN ZONE. FOR THE FIRE TO BE EFFECTIVE, THE TARGET MUST BE INCLUDED IN THE DANGEROUS ZONE.



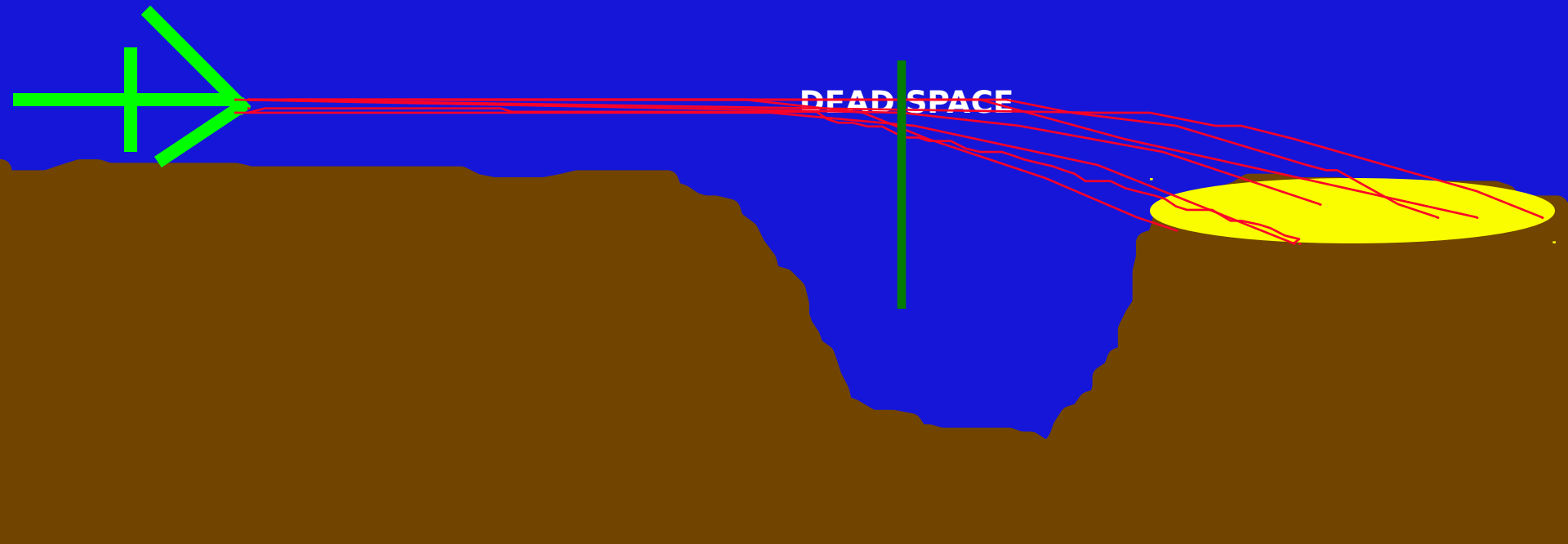


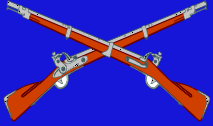
DEAD SPACE



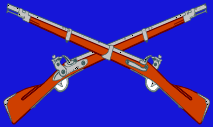
DEAD SPACE

ANY FOLD OR DEPRESSION IN THE GROUND THAT PREVENTS A TARGET FROM BEING ENGAGED FROM A FIXED POSITION IS TERMED DEAD SPACE.





FACTORS EFFECTING THE BURST OF FIRE



FACTORS THAT EFFECT THE BURST OF FIRE



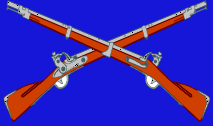
THE GUN

THE AMMUNITION

THE FIRER

CLARITY OF TARGET

AIR DISTURBANCES



TYPES OF FIRE

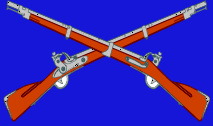


TYPES OF MG FIRE

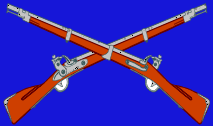
MACHINE GUNS PRODUCE TWO TYPES OF FIRE. IT IS CLASSED AS EITHER GRAZING FIRE OR PLUNGING FIRE.

THE TWO FACTORS THAT EFFECT THE TYPE OF FIRE PRODUCED BY A GUN ARE RANGE AND GROUND.

CONTINUED



GRAZING FIRE



GRAZING FIRE

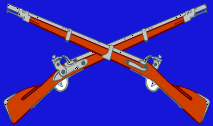


Grazing fire is obtained when firing over level or uniformly sloping terrain, where the center of the cone of fire does not rise more than 1 meter above the ground. this is approximately out to 600m. The dangerous zone, employing this type of fire, extends from the muzzle of the gun out to where the last round in the beaten zone strikes the ground.





PLUNGING FIRE



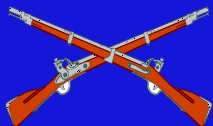
PLUNGING FIRE

PLUNGING FIRE IS ACHIEVED WHEN THE DANGEROUS ZONE IS PRACTICALLY CONFINED TO THE BEATEN ZONE. IT IS OBTAINED WHEN FIRING AT VERY LONG RANGES, FROM HIGH GROUND INTO LOW GROUND OR INTO ABRUPTLY RISING GROUND.





THE EFFECTS OF RANGE ON THE BEATEN ZONE



EFFECTS OF RANGE ON BEATEN ZONE



AS RANGE INCREASES, THE BEATEN ZONE BECOMES SHORTER AND WIDER, CAUSED BY THE INCREASED ANGLE OF DESCENT AT LONGER RANGES. THE EFFECTS OF RANGE ON THE BEATEN ZONE FOR BOTH THE M60 AND THE M240B ARE SHOWN BELOW

M60

RANGE: 500m 1 X 87 m



RANGE: 1000m 2 X 79 m



RANGE: 1500m 3 X 71 m



RANGE: 2000m 4 X 62 m



M240B

RANGE: 500m 1 X 110 m



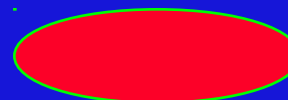
RANGE: 1000m 2 X 75 m



RANGE: 1500m 3 X 55 m



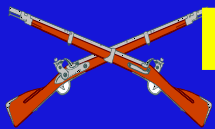
RANGE: 2000m 4 X 50 m



NOTE: THESE CALCULATIONS ARE PROVIDED AS A GUIDE LINE. ALTERATIONS TO THE SIZE OF THE BEATEN ZONE MAY BE CAUSED BY WORN BARRELS, WORN MOUNTINGS ON THE TRIPOD OR UNSTABLE MOUNTING OF THE BIPOD.



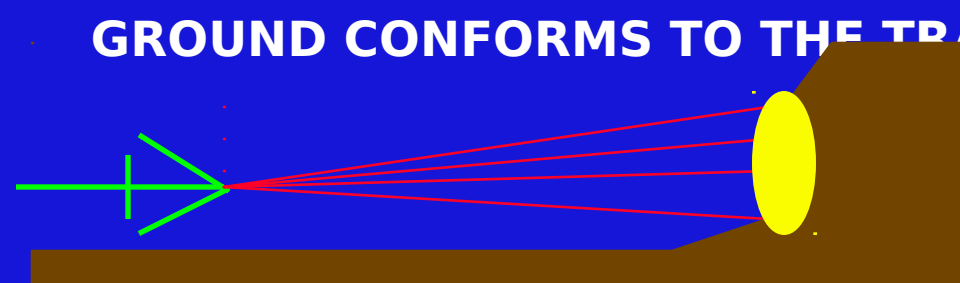
THE EFFECTS OF GROUND ON THE BEATEN ZONE



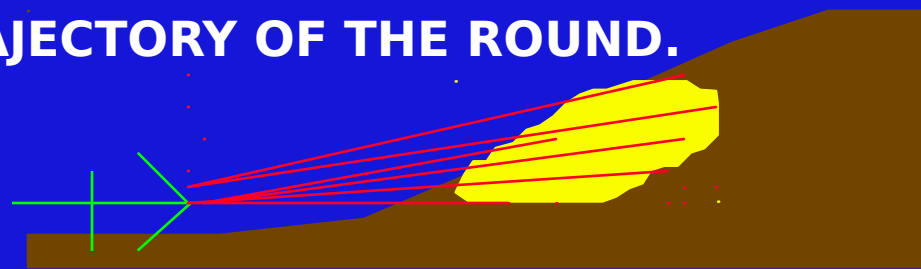
EFFECTS OF GROUND ON THE BEATEN ZONE



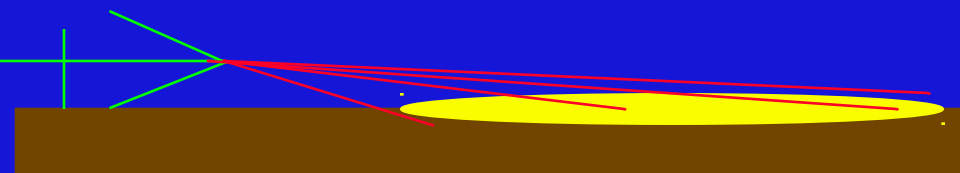
GROUND WILL HAVE A MARKED EFFECT ON THE LENGTH OF THE BEATEN ZONE. A CONE OF FIRE STRIKING A STEEP HILL SIDE WILL COVER A VERY SMALL AREA OF GROUND AND PRODUCE A SMALL BEATEN ZONE. THE SAME CONE OF FIRE STRIKING A MORE GENTLE SLOPE WILL PRODUCE A SLIGHTLY LARGER BEATEN ZONE. ON LEVEL GROUND THE BEATEN ZONE WILL BE STILL LARGER. THE LARGEST BEATEN ZONE WILL RESULT WHERE THE FALL OF GROUND CONFORMS TO THE TRAJECTORY OF THE ROUND.



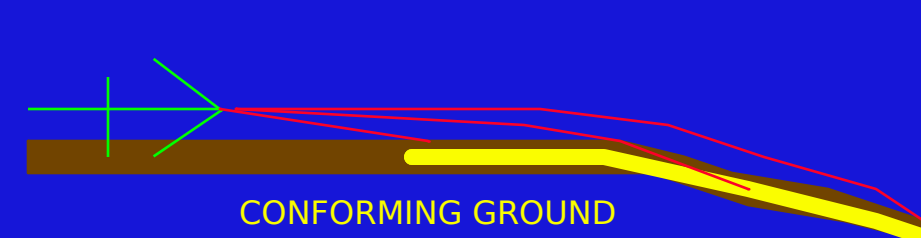
STEEP HILLSIDE



RISING SLOPE



LEVEL GROUND



CONFORMING GROUND



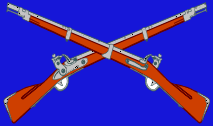
METHODS OF TARGET ENGAGEMENT



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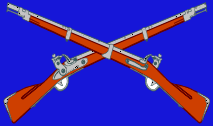
- TO OBTAIN THE MAXIMUM EFFECTIVE FIRE ON A GROUP OF TARGETS IT IS ESSENTIAL THAT THE MACHINE GUN IS SIGHTED SO THAT THE MAJORITY OF TARGETS ARE WITHIN THE BEATEN ZONE OF THE WEAPON. THIS SITUATION MAKES USE OF THE MAXIMUM EFFECTIVENESS OF THE SHAPE OF THE BEATEN ZONE AND IS TERMED ENFILADE FIRE.



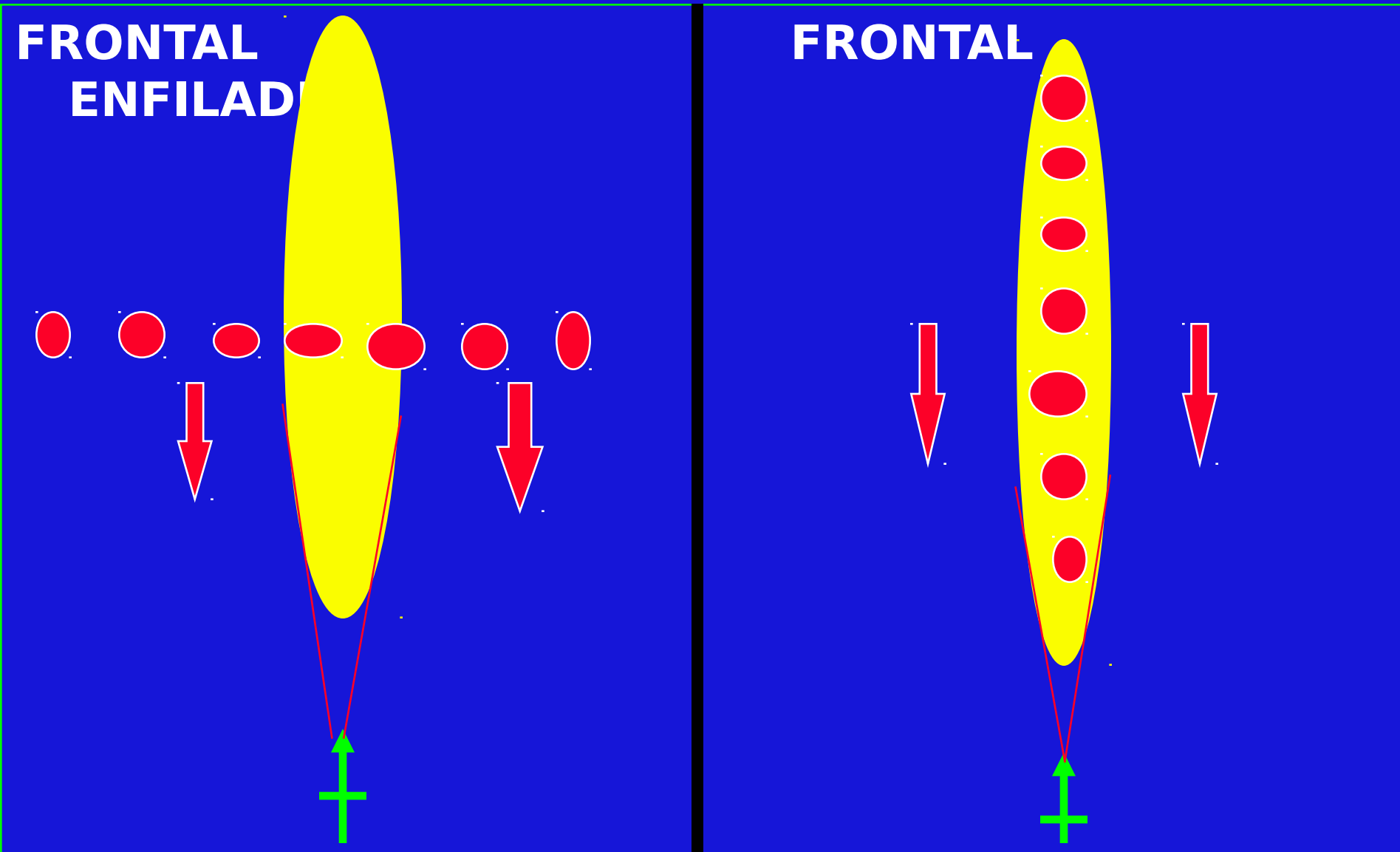
METHODS OF TARGET ENGAGEMENT

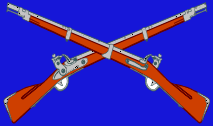


- **FRONTAL FIRE:** frontal fire is when the long axis of the beaten zone is at right angles to the front of the target.
- **FLANKING FIRE:** When delivered directly against the flank of the target.
- **OBLIQUE FIRE:** When the long axis of the beaten zone is at an angle other than a right angle to the front of the target.
- **ENFILADE FIRE:** When the long axis of the beaten zone coincides or nearly coincides with the long axis of the target. This type of fire is either frontal or flanking. It is the most desirable type of fire with respect to a target because it makes maximum use of the beaten zone.



FRONTAL FIRE

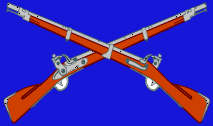




METHODS OF TARGET ENGAGEMENT



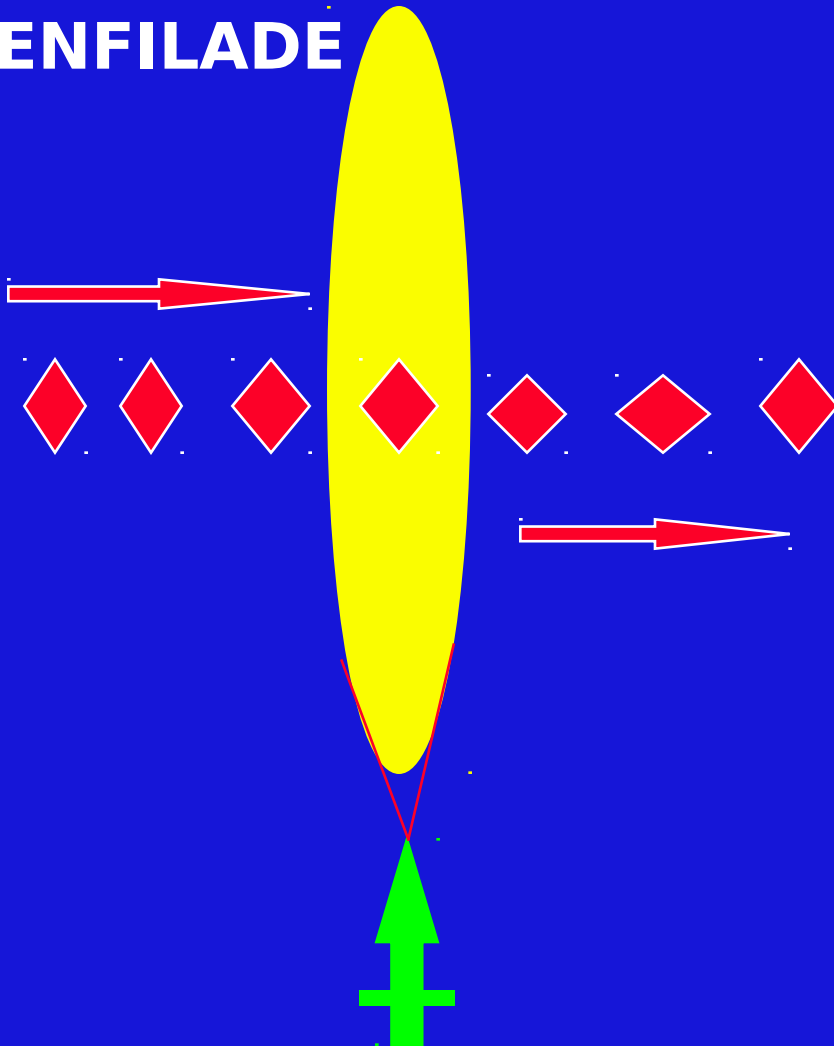
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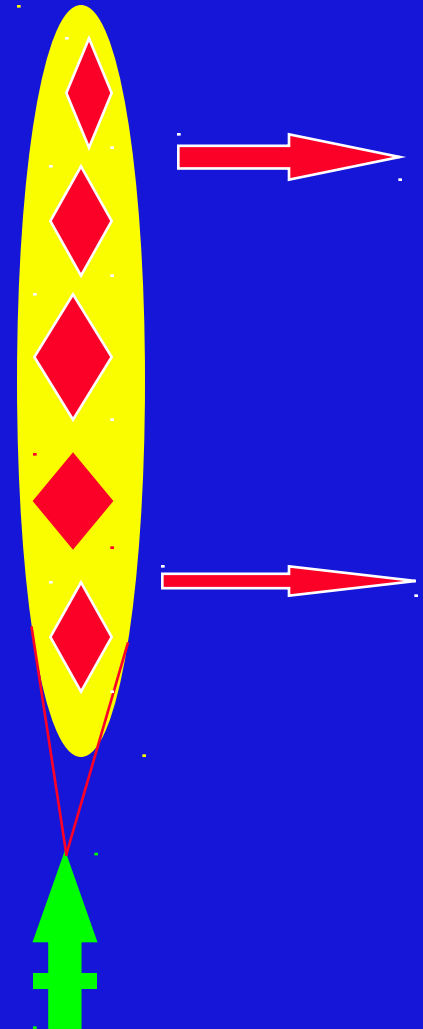
FLANKING FIRE

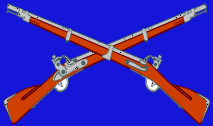


FLANKING ENFILADE



FLANKING

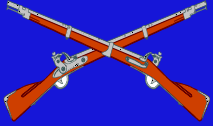




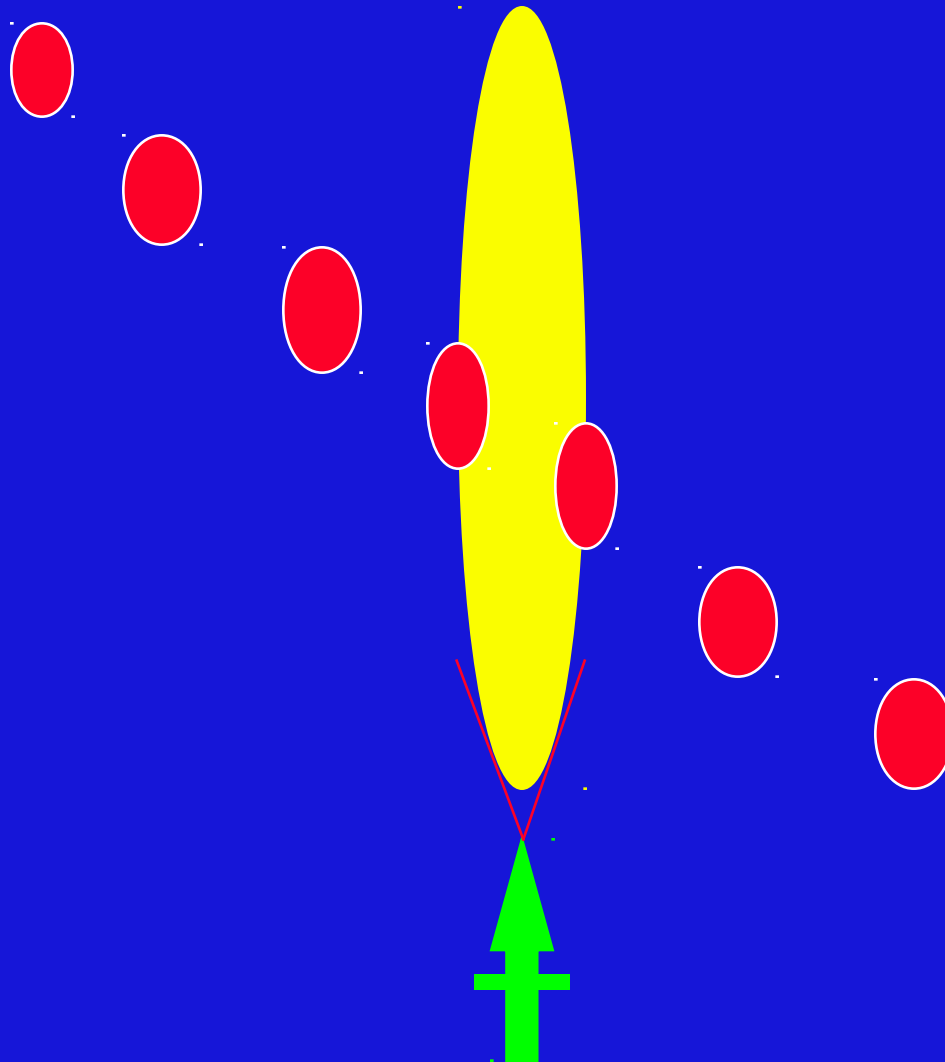
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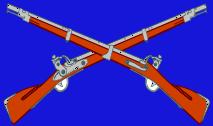


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OBLIQUE FIRE





METHODS OF TARGET ENGAGEMENT



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AIDS FOR OBSERVING FALL OF SHOT



AIDS FOR OBSERVING THE FALL OF SHOT

TO AID THE GUNNER IN DETERMINING THE EFFECTIVENESS OF HIS FIRE, THE FOLLOWING SHOULD BE REMEMBERED:

- **TRACER:** Tracer can be observed at ranges up to 1100m in normal circumstances.
- **GROUND:** Rounds falling on dry, sandy, or rocky ground will give a good indication of strike.
- **BATTLEFIELD CONDITIONS:** The actions of the enemy will often indicate whether the fire is effective.
- **CLIMATIC CONDITIONS:** When the sun is low, it is easier to observe strike than when it is high.



NOTES ON ZEROING



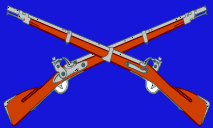
NOTES ON ZEROING



- **IF THE WEAPON IS NOT CORRECTLY ZEROED, IT IS INEFFECTIVE.**
- **BOTH THE GUNNER AND THE ASSISTANT GUNNER MUST ZERO THE WEAPON.**
- **THE SPARE BARREL MUST BE ZEROED, NOT JUST THE MAIN BARREL.**
- **THE AG MUST KEEP A RECORD OF HIS ZERO CORRECTIONS.**
- **THE WEAPON MUST BE ZEROED BEFORE ANY OPERATION, AFTER REPAIRS, WHEN GUNNERS CHANGE AND WHEN EVER THE ZERO IS IN DOUBT**



NOTES ON TRACER



NOTES ON TRACER



- **TRACER CAN BE OBSERVED OUT TO APPROXIMATELY 1100m.**
- **TRACER IS EXCELLENT FOR OBSERVING FALL OF SHOT.**
- **TRACER IS EXCELLENT FOR TARGET INDICATION BY DAY OR NIGHT.**
- **IF YOU CAN SEE WHERE YOUR ROUNDS ARE GOING, THE ENEMY CAN SEE WHERE THEY ARE COMING FROM.**
- **TRACER IS BEST USED 1 IN 5.**
- **100% TRACER LOOKS GREAT AT NIGHT, BUT IT WILL QUICKLY BURN OUT A BARREL.**
- **TRACER ROUNDS WILL EASILY CAUSE FIRES IN GRASS AND VEGETATION.**
- **AT NIGHT, UNLESS TRACER IS REQUIRED, CHANGE BELTS OR REMOVE IT.**





MG's IN DEFENCE



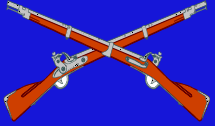
- **ROLE OF THE MG**
- **ALL ROUND DEFENCE**
- **MUTAL SUPPORT**
- **SITING OF GUNS**
- **DEPTH**
- **CONCEALMENT**
- **OBSERVATION AND FIELDS OF FIRE**
- **OBSTACLES**
- **ALTERNATE POSITIONS**



MG's IN DEFENCE



- **FIREPOWER**
- **SECURITY**
- **CONTROL**
- **COVERING GAPS**
- **COUNTER PENETRATION**
- **SPT LOCAL/DELIBERATE ATTACKS**
- **HARASSING FIRE**



MG's IN THE OFFENSE



- **ROLE OF THE MG**
- **MOVEMENT TO CONTACT**
- **THE ATTACK**

